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1

Introduction

While it has become a commonplace that innovations drive growth, it remains unclear whether innovations drive contraction as well. This book clears it up and finally puts the embodied innovations into the circle of recognised causes of economic crises. Unlike financial innovations that have already been much discussed as an alleged cause of the recent crisis, the real ones are still out of sight and out of mind while they merit consideration on their own.

The problem is that modern protagonists of the real technological causes of crises seek the truth in the stochasticities of fluctuations around some *right* trend, while recessions are part and parcel of the *right* trend itself, and even of an optimal “trend”.

This reproach concerns, first of all, real business cycle (RBC) theories and similar approaches. Still, many of today’s critiques of the RBC are too harsh. They confuse the correct idea with its poor analytical and numerical tractability and throw the baby out with the bath water.

Therefore, this book’s objective is to set this right and incorporate the fluctuations into the deterministic part of analysis. Such insight will open the way to predicting turning points in the economy in explicit terms of timing and figures of output and employment decline, rather than of probabilities and possibilities of crises onset.

The solution of this seemingly narrow problem involves consideration of a much wider range of tasks and issues.

First of all, this requires the prediction of the whole development cycle driven by innovations, which may include recession as an unavoidable phase.

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Then the question arises how to alleviate such unavoidable but manageable recessions, which evokes, in turn, the issues of monetary policies during such periods and so on.

Finally, the book comes to a concise description of how an innovative economy works in general and fluctuates in particular, including the interplay between its real and financial aspects. In this context, the book could be also treated as an effort to put forward new basics of economic knowledge and new direction in economics called Objective Marginalism.

For these reasons the book challenges a good many established theoretical and computational machinery. It challenges the whole tradition of shocko-mania – chasing after a mysterious host of shocks that every now and then knock the economy astray. It is astonishing, that the Dynamic Stochastic General Equilibrium (DSGE) approach accounts a dozen types of shocks without any particular effect for its forecasting ability. Yet Bank of England and the European Central Bank still rely on all this. So, the book pretends to provide the most economical explanation of crises/recessions in the sense that no special efforts are wasted for chasing after shocks. The main concern, after all, is an innovative growth where recession sometimes arises as a troublesome by-product.

It also challenges the centennial tradition of demando-mania, of demand-deficient versions of crises culminated in the Keynesian “deficient effective demand”. To clarify this in the most pure way, all the crisis analyses are carried out here under an absence of any problems from the demand side. Be the “demand” even unlimited, recessions would still occur.

These two “manias” belong to the mode of thinking that proceeds from an abnormality of crises. Surely, discoordination, imbalance, chaos and anarchy are capable to damage anything, not an economy only. While this book tries to contribute to the “normality thinking” and show that recession is a normal phase of innovative growth when progress is of a type of recession-fraught technological leap. This is in some sense an engineering type of recession that is not inherent specifically to capitalism or to any other social organisation.

At that, allowing for the universal and multi-directional character of modern technological advance, it is difficult to associate the leap with some of the most innovative innovation “guilty” for crisis, be it

nano, bio, ICT, “large scale” or “general purpose” ones. Consequently, the technological leap is an outcome of joint action of all the innovations and such nameless set of innovations is an unavoidable cause of the current crisis.

This overturns the dominant view that it is the financial crisis that has caused the economic crisis. In fact, the first falling dominoes triggering the domino effect of insolvency and bankruptcy are those individuals and firms who were deprived of their solvencies by virtue of unavoidable real recession. Of course, if over and above there are over-risky credits and over-indebtedness, all this aggravates the situation even more.

Thus, financial crisis has non-financial roots, and these are financial bubbles that are pricked by real structural changes, not the other way around. It should be remembered that the tradition of blaming the banking and monetary system for crises ascends to the first worldwide economic crisis of 1825. And it is natural enough that the blaming of real economy is not any younger, either, because just such was the defence put forward from the side of bankers. So, this book proposes a solution to fix this old dispute.

The book can also be classified as a development of the theory of technological evolution. This theory has already thoroughly studied the processes of diffusion of many specific innovations. So now, it is naturally time to take another step forward and study the simultaneous diffusion of all the multitude of innovations in all industries. This insight has afforded to discover an irregular slumping S-curve of overall innovative development of a whole economy, in addition to the traditional regular non-slumping S-curves for specific innovations.

Further, the Solow growth theory is judged as an over-simplified one that has buried the fluctuations beneath aggregation, and this holds for the related apparatus – reflection of technology by Cobb-Douglas function; measurement of progress by total factor productivity (TFP); and the indicators of marginal factor productivity.

This touches the topic of marginalism – a very vague notion that has diverse interpretations. We adhere to an objective marginalism based on heterogeneity of real producers. Consequently, an integral marginal producer, where labour and capital are coupled in a synergy, replaces the marginal labourer and the marginal unit of capital decoupled and separated.

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In the aspect of the financials, it is shown that the traditional general equilibrium is not altogether general and, in fact, is a special case of more general fundamental compromise.

The quantitative reflection of the above narratives is crystalised in a constructive framework capable to catch the turning points of the economy. The main distinctive features of the framework are: direct measurement of progress as the parameters of new technologies against old ones; reflection of the worker-workplace coupling; and holistic coverage of all technologies in all industries.

The peculiarity of the current state is that many elements of these theses have already featured in classic and modern works, showing that “the idea is in the air” and serving as inspirations for this book. The main of these inspirations are the following.

The *theoretical inspiration of the real part* is a forgotten seminal example left by David Ricardo to explain the “portion of inconvenience” from introduction of machinery.

In that example, a society had benefited from the redirection of its efforts to producing a machine not earlier than after some period of transition, being suffered from the decline in output of consumption goods at first. There was no need there neither in any additional crisis to induce the introduction of machinery, nor in compelling people to lose appetite to underpin a weak theory.

This logic of crisis – if an innovation requires an intensification of investment, then by the same token it requires a recession, because the intensification always runs at the expense of consumption – seems so simple that the science has not put much thought into it until now.

Anyway, even the most sophisticated modern quantitative schemes have managed to neglect this, whereby depriving themselves of the ability to catch the turning points in the economy instead of smooth trends and mere extrapolations.

So, this book does nothing but gradually carry Ricardo’s line through to an explanation and foresight of modern crises. It turns out that the old-fashioned hardships of accumulation of old capital are still valid for accumulation of new capital, too, albeit not so much for the latter.

This is a more substantial vision of the innovations-crises relations than, say, of Kurzweil (2003):

[E]xponential growth in the economy is a far more powerful force than periodic recessions. Even the “Great Depression” represents only a minor blip compared to the underlying pattern of growth. Most importantly, recessions, including the depression, represent only temporary deviations from the underlying curve. In each case, the economy ends up exactly where it would have been had the recession/depression never occurred.

Here again, the cause of recession looks like something mysterious and quite different from the cause of growth, and the so-called “underlying curve” is believed to be a very smooth one.

The *empirical inspiration* is the looked-at-but-not-seen phenomenon of jobless recovery, when the positive turn in output takes place earlier than the turn in employment. In such periods the production of fewer and fewer workers becomes higher and higher. Robert Hall, Chair-Director of NBER’s Program of Research on Economic Fluctuations and Growth, has rightly pointed to “the unprecedented growth of productivity” as a cause of the jobless recovery. Meanwhile, this unprecedentedness sprang up in the heat of crisis and may be pointed to as a cause of the crisis, as well. Besides, there are also clear evidences of vigorous structural changes too.

These facts cast doubt on the common rhetoric that it is crisis that forces capitalists to introduce new technologies to survive. How then a financial disorder could induce such an order of events in the real sphere?

It is none the better for the decline of aggregate effective demand. As if people at once lost their appetite to consume – and got eagerness to produce work. All this still needs theoretical explanation and practical implications.

Alexander Field has already drawn the attention that even the Great Depression was accompanied with great technological leaps. And he posed a crucial question now to be solved in this book: “whether there is a necessary connection between depression and rapid productivity growth [so that the depressions are] sacrifices...laying the foundation for a better tomorrow?”

This question is answered positively, so that the developed countries are first of all in the epicentre of technological and productivity leaps, and whereupon only in the epicentre of crisis. As for the catching-up economies like China or India, they are less touched by

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the crisis, just because they are primarily technological followers, not leaders.

This overturns the poor clichés infecting all groups of the public, who are still sure it was the financial meltdown that dragged the real economy down, and who are still wondering where the double dip and the second wave comes from.

The *inspirations of the financial part* came again from Ricardo, who left behind him the idea of marginal producer now evolved into the equilibrium of marginal producers; and from Pareto, who attempted to introduce some sort of a “general” theory of general equilibrium and whose version of welfare economics has opened the door to determine the quantities produced and consumed without resorting to prices. Now it turns into a proof that quantity and price are separate and sequential tasks, not simultaneous ones. This afforded to explain a prehistoric economy without exchange and helped to get a better understanding of modern market economy too.

The *inspirations of the constructive framework* also feature in various quantifying methods, not being put together yet.

Say, Leontief’s approach does reflect the worker-workplace coupling but measures progress indirectly as a gradual improvement of average characteristics of industries from year to year. This misled Leontief to an over-optimistic conclusion that “the economy is able to achieve a smooth transition from the old to new technologies”, while we would rewrite this in a more sober way: sometimes the economy is unable to achieve a smooth transition. Yet, although crises are unavoidable, their depth is manageable, and they eventually turn into growth.

On the other hand, the vintage capital growth theory does measure progress directly but does not reflect the worker-workplace coupling, whereby losing an ability to catch imbalances between them.

The practical effectiveness of the constructive framework has been confirmed both through the prototype economy and through the case of one of the actual crises.

These results proved that embodied innovations are most likely the main cause of crises. This by-innovations-driven cause stands out within the circle of other possible causes by its ability to replicate all the phases of actual business cycles acting purely alone. Besides, for the time being, this cause is one of the few that is articulately spelt out and explicitly forecast. Such a tool is able to reinforce the

forecasting and early warning teams with an ability to catch turning points in the economy instead of mere extrapolations.

Among other results, it is shown that the Keynesian easy monetary policy at crises is a paradoxical example of correct policy implications derived from an incorrect theory. The book backs up this type of anti-crisis policy with a more plausible theory and specifies its bounds more thoroughly.

Thus, the policy implications are that crisis is unavoidable but predictable and its depth is manageable. All that remains for policymakers is to learn to alleviate, not aggravate, the unavoidable. The same holds, of course, for better forecasting and influencing the innovative growth and development as such. As for the Great Depression, it was the case when the manageable depth had been unwittingly “managed” in the wrong direction, profoundly worsening the situation.

On the “third hand”, the book could be considered as an effort to consolidate the ideas and critiques proposed or highlighted recently. These are the following:

- That “money and finance are part of this story, not the story” (Winnett and Winnett, 2010).
- That “‘Blaming it on finance’ is an easy option...but the world is more complex and many drivers are present” (Winnett and Winnett, 2011).
- That there is a question “is something ‘deeper’ than financial instability happening?” (Ibid.).
- That “improvements in productivity can even lead to a fall in [employment]” (Kates, 2011).
- That “we need to take seriously...the so-called ‘real’ issues of innovation and growth which underpin cycles. These may or, most probably, are not manageable by (conventional) policy” (Winnett and Winnett, 2010).
- That “cyclical activity may be impossible to avoid” (Kates, 2011).
- That “growth is itself a cyclical process, driven by the very nature of capitalist development...[so that]...capitalist economies exhibit all sorts of inherent...instability” (Winnett and Winnett, 2011).
- That the “Keynesian-type policy interventions succeed only within tightly-defined limits” (Winnett and Winnett, 2010).

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- That “it is absurd to explain the current recession by deficient aggregate demand” (Kates, 2011).
- That the Solowian growth theory should be criticised for “the continuous incrementalism of the sort of ‘augmenting’ ... technical progress” (Winnett and Winnett, 2011).
- That prices are “variables exhibiting particular kinds of distribution” (Toporowski, 2011).
- That “dealing with nebulous terms ‘confidence’, ‘euphoria’ or ‘panic’ means perception rather than explaining events” (Kates, 2011).
- That there is “an appreciation of the difficulty and complexity of modelling the effect of various sorts of shocks on the time paths of prices and outputs. General models may not be available and this is *anathema* to modern modellers” (Winnett and Winnett, 2011).
- That there are theories that “... nominally explains ‘everything’ in fact explains nothing at all” (Mirowski, 2013).
- And, finally, that “one should return to the theories that modern macroeconomics replaced and that the classical teaching embodied some permanent truths of great significance” (Kates, 2011).

Most of these items are supported, but some are not.

Altogether, this book constitutes a new direction in economics – objective marginalism that is based on objective and real heterogeneity of producers. It explains economic development and cycle driven by innovations, and provides a tool for its practical application – constructive framework.

Just now, this direction resembles the periodic table rarely filled, yet, and this is promising for the future.

The book will be of value to the wide readership for three reasons:

1. The current crisis has impacted everyone’s life;
2. Meaningful interpretation and visualisation as well as invoking narratives prevail over the underlying computational formalism; and
3. The ideas are so simple that everyone has nothing to do but wonder how he had not come up with these revelations himself.

The organisation of the book is as follows. It is divided into three parts and fourteen chapters.

Part I describes real aspects of the cycle driven by embodied innovations; Part II describes the financial/monetary aspect. Such a division of the indivisible is resorted to for two reasons: (1) principally, providing real welfare is a necessary precondition to get profits and other monetary incomes. Besides, historically, the real preceded the financial, and (2) technically, the tradition of grasping everything at once brings about a multi-dimensional multiplicity of infinities, making an involute labyrinth where a researcher easily gets lost. There is a countless set of feasible paths of innovative development, each of which can in turn be financed in countless ways too; and over and above, there are countless oscillations generated by the market adjustment mechanism.

So, sometimes scholars are too hurried to sum up the pay-offs yielded by innovations, while the real preconditions to get those pay-offs are worthwhile to be considered beforehand, and the book adheres to the two-stage analysis. Consequently, Part II complements Part I, and both provide a consistent and coherent description how an innovative and heterogeneous economy, that is, the actual economy, works in general and fluctuates in particular. This pulls together both novelties and trivialities, and is intended for those more interested in the essence than in the associated history of economic thought or in the battles between competing schools. These latter are considered mainly in Part III.

More specifically, in Part I, a constructive framework is proposed – a practical framework sufficient to catch output and employment declines and other turning points in the economy numerically. Then, with an aid of this framework, the link of crises with embodied innovations is successively shown on an old example of a prototype economy and on concrete crises in modern economies. This has allowed, *inter alia*, to integrate the short and long runs together, and to answer the question posed by Nobel Prize-winning Professor Pissarides regarding the cyclical nature of fluctuations. At that, the notions of recession-fraught innovative situation and of irregular slumping S-shaped curve of overall innovative development are introduced.

In Part II, the financial and monetary aspects are overbuilt. Its theoretical foundation is Paretian welfare economics upgraded with objective marginalism. This afforded to propose a fundamental production-consumption compromise determining quantities produced and consumed without resorting to prices. Then, prices

are determined by the condition of equality of marginal producers or rule of invisible hand. At that, the traditional general equilibrium and the supply-demand paradigm are revisited. Apart of price, the categories of wage, profit, interest rate, money and non-neutrality of money, leverage, and stock price are also considered.

The material is illustrated with a simple example of heterogeneous economy, which threads throughout, growing in complexity with the unfolding of the narrative: from natural exchange of products to stock exchange and monetary policy.

Finally, this is crowned with a quantitative demonstration of dynamic interplay between prices, interest rates, savings and investments, wages, profits, losses, stock prices, and monetary policies at all the phases of a cycle driven by embodied innovations.

Part III is less systematic and contains in-depth discussion around some theoretical fundamentals and other issues of the previous parts. This relates to the concept of price, Ricardian and Marxian views of the connection of crises with accumulation and investment, prehistory of the Keynesian so-called effective demand and comparative analysis of some other approaches.

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